

**REMARKS**

Claims 1, 6 and 14-17 are pending in the present application. Claims 1, 6 and 16-17 are herein amended. No new matter has been presented.

**Rejections under 35 USC §102(b)**

**Claims 1, 6, 16 and 17 were rejected under 35 U.S.C. 102(b) as being anticipated by OHTAKI et al. (“Thermoelectric Properties of Al-doped ZnO Sintered with Nanosized Void Forming Agents.” Proc. of 22nd International Conference on Thermoelectrics. IEEE 2003: 171-74.)**

Claims have been amended for clarification. The amendment is supported in the original disclosure, for example, at page 13, lines 7-12, page 15, lines 5-11, and page 16, lines 7-12.

Amended claims 1 and 16 recite, among other things, “heating the shaped body to densify a solid part formed by sintering in an atmosphere where the void forming agent is not substantially gasified and is maintained without gasification in a sintered body.”

Amended claims 6 and 17 also recite, among other things, “forming the mixture into a shaped body while heating to densify solid material in the shaped body at a temperature where the void-forming agent is not substantially gasified.”

OHTAKI et al. does not teach or suggest these recitations of claims 1, 6, 16 and 17.

OHTAKI et al. was published by authors including the present inventor. The article discloses a method of producing the thermoelectric material having nanovoids by including VFA in producing the Al-doped sintered body.

OHTAKI et al. describes the method of producing ZnO sintered body that “The reactant powder thus prepared was ..., pressed into a pellet and sintered at 1400 °C for 10h.” (Ohki et al., p.171, right column, lines 2-3 from the bottom). It also describes that “VFA in this study are expected to be burned out during sintering process of the oxide and thereby isolated cavities are formed within densely sintered matrix.” (*Id.* p. 172, left column, lines 5-7, from the bottom).

At the time of the research which OHTAKI et al. was based on, it was generally known as a method of forming voids intentionally in a sintered body, to mix fine particles with a base powder and to sinter the mixture, where the fine particles are burned out during sintering process. Thus, the sintering method adopted in OHTAKI et al. is nothing more than the known one where the VFA are burned out. It is confirmed from the following description: “VFA in this study are expected to be burned out during sintering process of the oxide and thereby form isolated cavities within densely sintered matrix.” (*Id.*)

OHTAKI et al. also describes that, as a result of adopting such a known sintering method, voids having sizes of 0.5 - 3  $\mu\text{m}$  were formed when VFA of average diameter of 150 nm were used, and that many small voids having diameters of 50 -170 nm were formed besides the large pores of 0.5 - 3  $\mu\text{m}$ . (*Id.* p. 173, right column, line 3 from the bottom to p.174, left column, line 5 and Figures 8-10.)

As explained above, OHTAKI et al. discloses the structure of the sintered body having very large voids compared with the size of VFA, where the large voids are surrounded by nanosized voids, as a result of the burnout of VFA during the sintering. OHTAKI et al. reported that nanovoids were formed near the large pores of 0.5-3  $\mu\text{m}$ , but the sintered body obtained did not have enough thermoelectric characteristics and thus the method of OHTAKI et al. had little utility

as a method of producing thermoelectric material. Although OHTAKI et al. appears to be similar to the present invention at first sight, there is a breakthrough from the known method.

The present inventor continued research and tried a method in which VFA are not burned out during the sintering, contrary to conventional technical common knowledge that making VFA burned out during sintering and before getting the sintered body densely sintered. As a result, the inventor found a method of forming only the independent closed voids having almost the same sizes as those of VFA, without forming the large pores ca. 0.5-3  $\mu\text{m}$  that had been reported by the paper. By using VFA which are gasified by high temperature heating after the formation of densely sintered body, the gas generated by the gasification of the VFA diffuses out through the solid part sintered body and is removed. Such a mechanism of void formation is different in every way from the one reported by the paper where the large pores ca. 0.5-3  $\mu\text{m}$  are formed and where each of them are surrounded by a few nanovoids formed by VFA remained from being burned out.

In this invention, the inventor succeeded in forming the continuous electrical conduction paths inside the material by adopting such a new mechanism of void formation. As shown in Figures 4 and 6 attached to the specification, the sintered body of the embodiment of the present invention exhibits Power factor and Figure of merit having remarkable differences near 900 T/K from the reference. Such thermoelectric characteristics as shown there are extraordinary huge that person of ordinal skill of art could not imagine and thus proving usefulness of the method of the present invention.

For at least these reasons, claims 1, 6, 16 and 17 patentably distinguish over OHTAKI et al.

**Rejections under 35 USC §103(a)**

**Claims 14 and 15 were rejected under 35 U.S.C. 103(a) as being obvious over OHTAKI et al.**

Claim 14 depends from claim 1. As discussed above, claim 1 patentably distinguishes over OHTAKI et al. For at least these reasons, claim 14 also patentably distinguishes over OHTAKI et al. for at least the same reasons.

Claim 15 depends from claim 6. As discussed above, claim 6 patentably distinguishes over OHTAKI et al. For at least these reasons, claim 16 also patentably distinguishes over OHTAKI et al. for at least the same reasons.

In view of the aforementioned amendments and accompanying remarks, Applicant submits that the claims, as herein amended, are in condition for allowance. Applicant requests such action at an early date.

If the Examiner believes that this application is not now in condition for allowance, the Examiner is requested to contact Applicant's undersigned attorney to arrange for an interview to expedite the disposition of this case.

If this paper is not timely filed, Applicants respectfully petition for an appropriate extension of time. The fees for such an extension or any other fees that may be due with respect to this paper may be charged to Deposit Account No. 50-2866.

Respectfully submitted,

**WESTERMAN, HATTORI, DANIELS & ADRIAN, LLP**

/SADAO KINASHI/

Sadao Kinashi  
Attorney for Applicant  
Registration No. 48,075  
Telephone: (202) 822-1100  
Facsimile: (202) 822-1111

SK/kn